

## 8.0 Intelligent Transportation Systems

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#### 8.1 Utilization of New Technology

Sometimes travel can be a challenge. The challenges can include winter weather conditions, and increased numbers of vehicles, especially during peak tourist season. In addition, vehicle crashes can cause delays on particular corridors where there are few alternative routes.

The application of electronic and communications technology can help to relieve some of these problems. These technologies, collectively labeled as ITS, have potential benefits in the following areas:

- Capital, operations and maintenance cost savings
- Safety and security
- Energy and environment
- Service quality
- Efficiency
- Productivity

MaineDOT is investing in the state's transportation future by using technologies and strategies to help enhance quality of life and to facilitate daily activities such as:

- getting to work
- taking the kids to social or educational activities or events
- going for a weekend drive in the country
- driving a truck across the state to move goods
- using alternative modes of travel

The Department has made significant strides since our first State of the System Report in 2002 in developing "Intelligent Transportation Systems". MaineDOT has made significant progress in the following areas:

- Traffic management
- Travel information (including flood and weather information)
- Public transit management
- Safety measures
- Commercial Vehicle Operations (CVO)

MaineDOT is not making these transportation improvements alone. Stakeholder partnerships are key. These strategies and initiatives require time, money, and a team effort. Maine uses proven 21<sup>st</sup> century technologies in a series of projects designed to provide benefits for Maine's transportation system and economy. We are making travel for Maine's citizens and visitors **Safer - Faster – Smarter**.

In 2005 the Department completed two major initiatives focused on coordination and planning for future ITS integration and deployment. Those initiatives were the development of: 1) the ITS Integration & Operations (I&O) Plan, and 2) the identification of Statewide ITS Architecture. The I&O Plan was a study that included stakeholder meetings, an ITS needs assessment, a review of available technologies,

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recommendations for ITS implementation, organizational recommendations for ITS, and an initial outline of the Statewide ITS Architecture needs. The Statewide ITS Architecture is required for Federal ITS funding and is aimed at creating a conceptual framework for future ITS developments.

The following figure 8.1 represents an inventory of existing ITS deployments statewide. In order to be consistent with this document and the ITS Statewide architecture market package, system headers and designations are used.

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### 8.1 Existing ITS

Market Package/ System	Deployment Location(s)	Responsible Agency	Description/Notes
<b>TRAFFIC MANAGEMENT</b>			
<b>Network Monitoring</b>			
MaineDOT Radio Room	Augusta	MaineDOT	24/7 operations, provides Traffic Operations functions Activates Radio Operated Speed Signs
MaineDOT Field Devices	Statewide	MaineDOT	11 permanent class stations 42 permanent count stations 1000+ short term counting sites
MaineDOT Field Devices	Various Locations Statewide	MaineDOT	Truck Speed Warning Systems, Road sensors/classifiers, Flashing beacons.
Local Field Devices	Norridgewock	Local Municipalities	Town of Norridgewock Intersection Collision Avoidance Warning System (ICAWS) Warn drivers on side streets of main street activity. More automated system planned in 4 years.
MaineDOT Field Devices	I-95 North of Augusta	MaineDOT	Radio Operated Speed Signs (ROSS) Beacon Signs
<b>Traffic Information Dissemination</b>			
MaineDOT Regional Offices/ Camps	5 locations	MaineDOT	District Headquarters Traffic Operations Center Functions
MaineDOT Field Devices	Statewide	MaineDOT	Changeable Message Signs (CMS) Several with cellular communications Controlled from districts
<b>Advanced Railroad Grade Crossing</b>			
Wayside Equipment	Statewide	Amtrak	Horn and actuated signal systems. Prediction systems Amtrak Downeaster grade crossing systems.
<b>Parking Management Systems</b>			
Parking Management System	Acadia National Park	Downeast Transportation Inc.	Sand Beach Parking Lot Vehicle counting, video surveillance Info available on 511
<b>Drawbridge Management</b>			
Bridge Control Tower	Statewide (7 Locations)	MaineDOT	7 bridges are staffed 24/7.
Bridge Control/Warning	Casco Bay Bridge	MaineDOT	Roadway signs for "Bridge Open"

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Market Package/ System	Deployment Location(s)	Responsible Agency	Description/Notes
Devices			Bridge operator has internet capability (could enter data into ISP)
<b>PUBLIC TRANSPORTATION</b>			
<b>Transit Vehicle Tracking</b>			
GPCOG Communications Center	Portland	GPCOG	Houses the server that supports transit AVL
Transit Vehicle	Portland	Transit Service Providers	AVL - Portland Explorer pilot study (3 vehicles). Vehicle position displayed on TIDS. (GPCOG)
Transit Vehicle	Mount Desert Island / Acadia National Park Schoodic Peninsula	Downeast Transportation Inc.	Integrated system: AVL, APC, 511 link, and a Station/Stop Annunciation System. (Downeast Transportation Inc.)
<b>Transit Fixed Route Operations</b>			
Transit Management Center	Portland	Transit Service Providers	Fixed Route Scheduling Software (METRO)
Transit Management Center	Mount Desert Island / Acadia National Park Schoodic Peninsula	Transit Service Providers	Fixed Route Scheduling Software (Downeast Transportation Inc.)
<b>Demand Response Transit Operations</b>			
Transit Management Center	Portland	Transit Service Providers	Computer Aided Dispatch System (RTP)
<b>Transit Passenger and Fare Management</b>			
Transit Vehicle	Mount Desert Island / Acadia National Park Schoodic Peninsula	Transit Service Providers	APC: Integrated system: AVL, APC, 511 link, and a Station/Stop Annunciation System. (Downeast Transportation Inc.)
<b>Transit Security</b>			
Transit Vehicle	Mount Desert Island / Acadia National Park Schoodic Peninsula	Downeast Transportation Inc.	Mayday Mobile Data Terminals installed on new transit line. (Downeast Transportation Inc.)

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Market Package/ System	Deployment Location(s)	Responsible Agency	Description/Notes
<b>Transit Traveler Information</b>			
Transit Vehicle	Mount Desert Island/Acadia National Park Scoodic Peninsula	Transit Service Providers	Passenger Information Display System (PIDS) Station/Stop Annunciation System (Downeast Transportation Inc)
Traveler Information Display Systems (TIDS)	Portland	Greater Portland Council of Governments (GPCOG)	7 TIDS locations including Jetport. Information displayed includes: Ferry services, busses, Airlines <a href="http://www.transportme.org">www.transportme.org</a>
Flight information Display System (FIDS)	Portland	Airport Authorities	Automated (real time) system displays flight status from the Jetport. Information displayed on TIDS.
Transit Website	Statewide	MaineDOT	CARS – MODES: Pilot phase with 6 transit agencies. Internet access to schedule and real time transit info. Expansion to 20 agencies - bus transit and rail (Amtrak) and Island Explorer. No pre-trip planning.
GPCOG Communications Center	Portland	GPCOG	24/7 communication center, provides Transit ISP functions
<b>COMMERCIAL VEHICLE OPERATIONS</b>			
<b>Electronic Clearance</b>			
Unified Motor Carrier Administration Management System (UMCAMS)	Statewide	Bureau of Motor Vehicles (BMV)	UMCAMS Database. Real time credentialing to SP Commercial Vehicle Enforcement Unit (CVEU) vehicles through website.
<b>Weigh-In-Motion (WIM)</b>			
Commercial Vehicle Roadside Inspection Station	Statewide Verona Island Old Town	MaineDOT	Weigh in Motion: 13 sites. Most sites used for planning Old Town location used to prescreen vehicles.
<b>ARCHIVED DATA MANAGEMENT</b>			
<b>Data Warehouse</b>			

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Market Package/ System	Deployment Location(s)	Responsible Agency	Description/Notes
Transportation Information for Decision Enhancements (TIDE).	Augusta	MaineDOT	GIS data warehouse 15 years of crash/traffic counter data. Information provided from the local police to the state police to the DOT to TIDE. MaineDOT Planning section is building a new crash records system.
CARS (Condition Acquisition System and Reporting System)	Statewide	MaineDOT	CARS provides most of the core information on road and traffic conditions in the TRIO architecture. It has been deployed in all three states and functions as the central repository for travel information pertaining to the highway system.
<b>Interactive Traveler Information</b>			
TRIO Tri-state Travel information online	Statewide	MaineDOT	TRIO Database Amber alerts are not yet active but will be inputted to ISP in 2005.
511	Statewide	MaineDOT	Advanced travel information by telephone
www.511me.com	Statewide	MaineDOT	Website for traveler information
<b>MAINTENANCE AND CONSTRUCTION MANAGEMENT</b>			
<b>Road Weather Data Collection</b>			
Roadway Weather Information Systems (RWIS)	Statewide	MaineDOT	MaineDOT owns four full RWIS and one mini RWIS station.
State Maintenance Vehicle	Statewide	MaineDOT	MaineDOT SIR vehicles infrared sensors Air and pavement temperature readings called into the Radio Room and maintenance camps.
<b>Weather Information Processing and Distribution</b>			
Surface Transportation Weather Service	Statewide	MaineDOT	This ITS subsystem represents the providers of specific meteorological services. These providers utilize National Weather Service data and predictions, road condition information and local environmental data.
<b>Transportation Infrastructure Protection</b>			
Infrastructure Safety and Security Monitoring Systems	Waldo-Hancock Bridge (Verona Island)	MaineDOT	Advanced warning systems for overweight vehicles.
Infrastructure Safety and Security Monitoring Systems	Waldo-Hancock Bridge Deer Island	MaineDOT	The bridge breach system will be monitored by MaineDOT bridge control, and the maintenance camps near the facility. Waldo Hancock – cables on this bridge will be monitored for breaches at Waldo Hancock Facility.

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Market Package/ System	Deployment Location(s)	Responsible Agency	Description/Notes
			Deer Island – cable suspension bridge monitored locally for wind speed, velocity and movement.
Infrastructure Safety and Security Monitoring Systems	Statewide	MaineDOT	USGS River gauge information flows to Maine OIT. MaineDOT M&O monitors data (website) for water levels, ice flows, alarms. EOC monitors river gauges through SWIMS
Infrastructure Safety and Security Monitoring Systems	Portland Augusta Casco Bay Bridge Aroostook County	MaineDOT	Surveillance Cameras Portland - waterfront cameras to monitor port traffic. Piscataquis Bridge – Installed by NHDOT

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**TRavel Information Online** - The Department has made significant strides since our first State of the System Report in 2002 in developing “Intelligent Transportation Systems”. The majority of the work to develop the information system has initially been accomplished in partnership with two other New England States, New Hampshire and Vermont. The project has been named **TRIO, TRavel Information Online**. The TRIO project provides accurate and real time information on road conditions, road work, weather alerts and advisories, incidents, local events and any major delays that occur on the highway system. Travelers can make informed decisions before and while on their trips using their phones and by looking for information on the internet at MaineDOT’s 511 websites. We are in the process of deploying Changeable Message signs in both the Portland and Bangor areas.

**CARS (Condition Acquisition and Reporting System)** - Maine has also partnered with five additional states using the CARS software system in a “Pooled Fund” approach to system operations and improvements. CARS uses the World Wide Web to allow authorized staff to input construction, accident, delay, and other roadway, weather and tourism event information into statewide databases. The CARS server also supports routine MaineDOT dispatch, press release and emergency response activities.

**FORETELL Road and Weather Prediction System** - FORETELL complements CARS by adding a predictive component to road condition reporting. FORETELL is designed to meet the winter information needs of travelers and highway maintenance managers, combining weather and road condition predictions every hour for up to 24 hours ahead.

**511 Interactive Voice Response System and [www.511Maine.gov](http://www.511Maine.gov)** - MaineDOT launched the 511 website and 511 interactive telephone voice response systems in 2003. These were the first deployments of dissemination systems providing real time travel information contained in the CARS system. In 2004, MaineDOT was the first in the nation to offer real time travel information in a foreign language with the deployment of our 511 website in French. Information includes:

- Highway Traffic
- Road Weather
- Regional Summary
- Acadia National Park and Bar Harbor Region, Tourism
- Ferry Service & Transit
- Other States
- Help with 511
- All Advisories
- Major Delays
- Roadwork
- Road Conditions
- Weather Forecasts and Weather Alerts
- Commercial Vehicle
- Links to the Maine Office of Tourism, MTA, Acadia National Park and Public Transit information,
- Traffic cameras at key points on Maine highways and the MSFS.

511Maine has had over 1.1 million hits since May of 2003.

### AMBER ALERT

The AMBER (America's Missing: Broadcast Emergency Response) Plan Program is a voluntary program through which emergency alerts are issued to notify the public about abductions of children. These child abduction alerts may be communicated through various means including radio and television stations, highway advisory radio, changeable message signs (CMS), and other media.

The AMBER Plan Program encourages use of the most effective methods to communicate with the public on behalf of abducted children. The CMS can convey only a limited amount of information to motorists. When there is a need to provide extensive information to motorists, it is critical that other types of traveler

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information based media (e.g., 511, highway advisory radio, web sites, commercial radio) be used, or that the messages displayed on a CMS supplement these other media. We continue to discourage the display of general public information or other nonessential messages on CMS.

### **CARS – MODES**

The CARS – MODES module of the TRIO project addresses the development of multi-modal transit information by developing new software to handle transit's special characteristics, including schedules, routes, and connections. MODES will integrate published schedules with transit events such as service disruptions.

### **CARS-CVO**

The CARS-CVO (Commercial Vehicle Operations) supports oversize and overweight permitting. The CARS-CVO application will allow entry of permit application information including carrier information, commercial vehicle parameters, time/date of travel, and selected routes of travel into the system. CARS-CVO will allow the permit clerk to issue permits and inform commercial carriers about any restrictions that might prevent their travel.

### **8.3 Commercial Vehicle Intelligent Transportation Systems**

As a member of the Intelligent Transportation Systems/Commercial Vehicle Operations (ITS/CVO) Working Group, MaineDOT supported several initiatives to utilize emerging ITS technologies in commercial vehicle operations. The working group sponsored a project to install the Unified Motor Carrier Account Management System UMCAMS at the BMV. This system ties together several motor carrier databases on commercial vehicle registration, fuel tax and federal safety inspection ratings (PRISM) using the USDOT numbers as a common identifier. This system makes these data available to State Police enforcement personnel in the field on a 24/7 basis via laptop computers in enforcement vehicles. Plans are to fund further enhancements including access to court violations and safety data, and an electronic weight violations process. Thus far, UMCAMS has been deemed highly successful by the BMV and the Maine State Police, who use the system extensively in their field enforcement activities. MaineDOT is undertaking a project to provide vehicle screening at the Kittery-York weigh stations. Weighing and credential screening technology will enable compliant motor carriers to bypass enforcement details, allowing enforcement to concentrate monitoring efforts on non-compliant vehicles. Systems will include ramp weigh-in-motion, height detectors, and transponder readers capable of interacting with vehicle transponders in mainstream traffic.

### **8.4 Planned ITS Projects**

The ITS Strategic Plan and the ITS Architecture project recommend a series of ITS projects that will assist in providing better, more reliable, more efficient, and safer transportation to residents and tourists. These projects have been recommended based on stakeholder outreach and needs assessments.

The ITS Program from the MaineDOT ITS Strategic Plan for the next 10 years is outlined in figure 8.2 below. This fiscally unconstrained plan involves about \$30 million worth of ITS projects based on a statewide needs assessment. The current Capital Work Plan includes about \$7 million towards these goals. The figure does not include an additional \$2.5 million for 511 operations and CARS enhancements.

## **8.2 Summary of Planned ITS Projects and Costs**

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ITS Projects	Average Capital Cost (\$)	Average Operations & Maintenance Costs (\$)
<b>Traffic Management Project</b>		
Statewide ITS Architecture	\$125,000	\$20,000
Arterial Traffic Management System	\$825,000	\$82,500
Traffic Incident Management	\$1,485,000	\$148,500
Traveler Information System	\$5,730,000	\$573,000
Staff Training and Public Outreach	\$350,000	\$35,000
<b>Subtotal</b>	<b>\$8,515,000</b>	<b>\$859,000</b>
<b>Maintenance and Operations Project</b>		
AVL for Winter Maintenance	\$2,000,000	\$200,000
Road Weather Information System	\$1,782,000	\$178,200
Work Zone Management And Safety System	\$965,000	\$96,500
<b>Subtotal</b>	<b>\$4,747,000</b>	<b>\$474,700</b>
<b>Safety and Emergency Management Project</b>		
Intersection Collision Avoidance	\$105,000	\$10,500
Animal Collision Avoidance Pilot Study	\$20,000	\$2,000
Highway Rail Intersection Pilot Study	\$1,000,000	\$100,000
Pedestrian Safety Systems Pilot Study	\$10,000	\$1,000
Traffic Operations Center Development	\$4,725,000	\$750,000
Critical Infrastructure Monitoring Systems	\$380,000	\$38,000
<b>Subtotal</b>	<b>\$6,240,000</b>	<b>\$901,500</b>
<b>Commercial Vehicle Operations Project</b>		
CV credentialing and screening systems	\$1,540,000	\$154,000
HAZMAT coordination system	\$290,000	\$29,000
CVO outreach	\$225,000	\$22,500
<b>Subtotal</b>	<b>\$2,055,000</b>	<b>\$205,500</b>
<b>Transit Projects</b>		
CAD/AVL	\$1,901,000	\$193,300
Fixed route scheduling	\$368,000	\$53,600
Automatic Passenger Counters	\$417,000	\$31,100
Automated Annunciation System	\$763,000	\$55,500
Website enhancements	\$106,000	\$10,600
En-route traveler information	\$425,000	\$62,100
Electronic Payment System	\$2,280,000	\$136,200
Park & ride information	\$155,000	\$10,400
Vehicle component monitoring	\$158,000	\$13,300
<b>Subtotal</b>	<b>\$6,448,000</b>	<b>\$566,100</b>
<b>Grand Total</b>	<b>\$28,130,000</b>	<b>\$3,006,800</b>

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### 8.5 ITS Technology Performance Evaluation

The purpose of a monitoring and evaluation program is to determine the success of project implementations and to document lessons learned. MaineDOT recognizes the importance of performance evaluation; monitoring and evaluation is an important part of ITS program management. It consists of measuring the effects of deployed projects, with the goal to better understand and improve on operations.

There are several reasons why it is important to monitor and evaluate projects, including:

- Verifying whether or not the ITS project sponsor and partners are accomplishing objectives and obtaining needed information.

- Helping to understand the causes of problems associated with project deployment, and finding ways to resolve issues;

- Offering ideas on how to plan for future deployments of similar projects;

- Helping other projects move forward, by sharing lessons learned from the project implementation experience.

The following figure outlines goal areas and measures that will be used to evaluate ITS deployments.

**8.3 Evaluation Goals & Measures of Effectiveness**

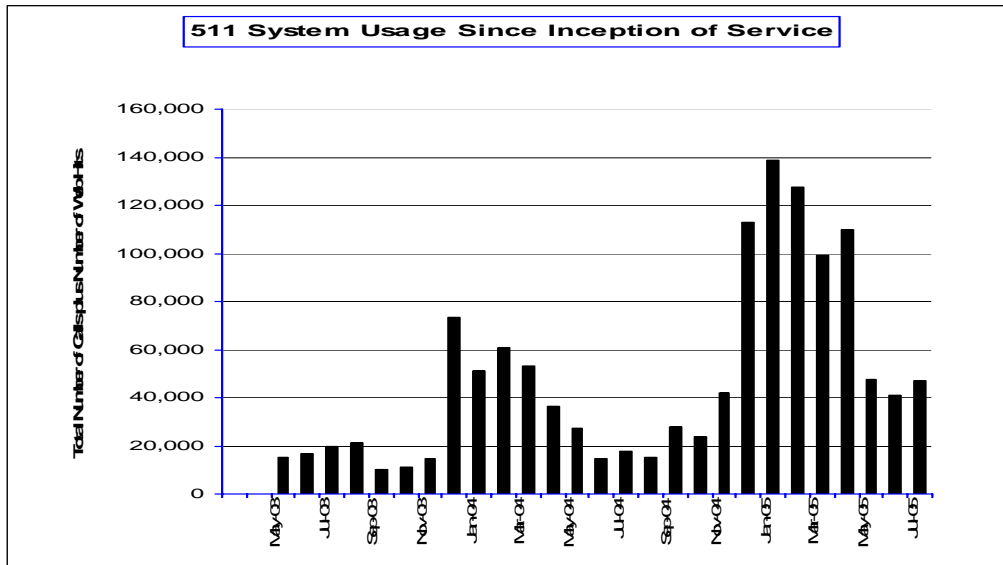
Goal Areas	Measures
Safety	Reduction in the overall Rate of Crashes Reduction in the Rate of Crashes Resulting in Fatalities Reduction in the Rate of Crashes Resulting in Injuries
Mobility	Reduction in Travel Time Delay Reduction in Travel Time Variability Improvement in Customer Satisfaction
Efficiency	Increases in Freeway and Arterial Throughput or Effective Capacity
Productivity	Cost Savings
Energy and Environment	Decrease in Emissions Levels Decrease in Energy Consumption

Much of MaineDOT's ITS deployment program is in its early stages. The effectiveness of various initiatives has not been fully evaluated, though early indications are very favorable for several initiatives.

For example, public use of the 511 system has grown dramatically since its inception in 2003 as shown in figure 8.4 below.

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### 8.4 Number of Calls for 511 System



The Department's participation in the Acadia National Park *Island Explorer* project has received national recognition. The project was the subject of a Federal evaluation. The excerpt below gives an indication of the public satisfaction with the technologies deployed there.

#### **90% of visitors surveyed at the Acadia National Park in Maine say transit information signs made it easier to get around.**

A primary objective of the Acadia National Park field operational test was to provide timely and accurate information to visitors about the Island Explorer shuttle bus service. As part of the test, electronic message signs were installed at bus stops at three of the most popular destinations in the park, and visitors were given real-time transit status information showing updated bus departure times. In addition, shuttle buses were equipped with on-board next-stop announcement systems to inform riders of the approaching destinations as they traversed the park.

According to the survey, most visitors found the information they received to be accurate, clearly understandable, and easy to use. Ninety percent of visitors who used the real-time transit departure signs, and 84% of visitors who experienced the automated on-board next-stop message announcements, agreed these technologies made it easier to get around.

### **8.6 ITS Funding Scenarios & Implications**

Because ITS is an area of increasing emphasis within the transportation sector, the assumptions on status quo funding are difficult to make. Making assumptions about future technology is a little like predicting the future direction of computer technology. Most of the ITS implementations are new initiatives that have begun only recently. MaineDOT is fortunate to have received Federal support for many of the new ITS projects. The baseline assumption would be continued ITS funding at the current level of \$ 7 million per biennium.

The ITS Statewide Strategic Plan recommends a \$30 million investment over the next ten years. Additionally another \$2.5 million will be needed for 511 operations and CARS enhancements.

However the Strategic Plan suggests first priority deployments over the first three years that amount to nearly \$23 million. The selection of priority projects is based on their being either essential "foundation" projects or "early winner" projects that provide high benefits in combination with modest capital cost, to help build public and legislative support for the ITS program.

The potential implications of maintaining status quo investment include slower public/political support and acceptance and inefficiencies in program development. For example our current operations center, the radio room, may not be the most effective facility to operate dynamic message signs, incident

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management systems, critical infrastructure security systems and other ITS devices. The 2006-07 Capital Work Plan funds only a feasibility study and business plan development for a statewide traffic operations center. Careful planning and deployment of systems can offset this potential problem.

### Increase 20% Scenario

A 20% increase in that level would mean that an additional \$1.4 million would be available for ITS infrastructure. This amount is roughly equivalent to the capital requirements for a single arterial traffic management system such as currently proposed for Western Avenue in Augusta. The 20% increase in funding would mean that one more clogged arterial could have a coordinated signal system. In other states these kinds of optimized signal systems have been shown to reduce delay by 14-19% and reduce vehicle emissions by 9-13%, providing both congestion relief and environmental benefits. This result represents direct, positive, measurable benefits for Maine.

As another example, an Interstate highway traffic incident detection system is planned for the I-295 area near Portland to mitigate the effects of traffic incidents on congestion. The current Capital Work Plan includes the project at a cost of roughly \$1 million. An increased ITS funding level of \$1 million would pay for an additional incident detection system for another Maine arterial. The projected benefit/cost ratio for this system is 6:1. In addition, states that have evaluated these systems have reported a decline in average incident duration at those locations by 15-30% and average delay per incident has declined by 36-66%. This reduces fuel consumption and lost time by similar amounts as well, leading to productivity gains and environmental benefits.

### Decrease 20% Scenario

A 20% decrease in funding level would mean that \$1.4 million less would be available for ITS infrastructure. This would involve extending the implementation and build-out of the ITS Strategic plan by possibly two years. This could mean reductions in traveler information systems, commercial vehicle credentialing systems, work zone safety technologies, transit vehicle location or maintenance technologies, and might delay the continuing development of traffic operation center (TOC) capabilities. All of these types of initiatives combined represent about \$1 million in the current Capital Work Plan. National studies have shown 12% improvements in system efficiencies using TOC technologies. States that have used new work zone technology have reported decreased queue lengths of 33%. Productivity gains from CVO credentialing cannot be overestimated, as other states have reported 4:1 benefit/cost ratios for these systems. Millions of dollars in fuel and labor savings have been reported nationally. The motor carrier industry estimates the benefit/cost of automatic credentialing systems to be in the order of 6:1 to 10:1. The benefits of message signs and traveler information would also be affected. Information from other states shows satisfaction ratings of 75-90% from motorists in the areas of accuracy, availability, usefulness and understandability of Travel Information Systems such as Maine is currently developing.

## 8.7 Conclusions

**8.5 Maine's ITS Needs (in millions of 2005 dollars)**

	2002-2003	2004-2005	2006-2007	STATUS QUO Investment Level (Average Over 3 Biennia)	To Maintain Constant Performance/Condition	Biennial Strategic Need
ITS			4.6	4.6	1	6.6